

$\text{Nd}_6(\text{Fe},\text{Co},\text{Al})_{14}$ (δ), m phase and hex. $\text{Nd}_2(\text{Fe},\text{Co})_{15}\text{Al}_2$ (2:15:2) crystalline phases embedded in an amorphous matrix were identified. The grain size of the crystallites is ranging from 3 nm to 250 nm. The 2:14:1 phase is supposed the high coercivities up to 1202 kA/m at room temperature of the NdFeCoAlB alloys. Other antiferromagnetic phases as the 2:15:2, δ phase can be played an important role in hard magnetic properties of alloys at low temperature ranges. The amorphous phase with high fraction was found in all of these alloys have also good hard magnetic properties (higher than 3 kOe). In the NdFeCoAlC alloys, we did not find the crystalline phase 2:14:1 but still obtained higher 7 kOe in coercivity.

Keywords: hard magnetic materials, TEM, scanning electron microscopy

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Negative and low positive thermal expansion behaviour of niobate based ceramics and solid solutions

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Our understanding of the thermal behaviour of the solid state has led to the development of novel materials that encompass many diverse applications. In this regard materials that possess negative and low positive coefficient of thermal expansion are of interest because they have a number of possible engineering, electronic and optical applications. Currently, negative and low positive coefficients of thermal expansion have been observed in several metal oxide, natural mineral and alloy systems [1]. In this study the thermal expansion of several Niobate (Nb_2O_5) ceramic and solid solution systems were investigated. Currently, negative thermal expansion behaviour has been observed in $\text{TiO}_2\text{-Nb}_2\text{O}_5$ and Nb_2O_5 ceramic and single crystal materials [2]. The materials under investigation in this study include ceramics and solid solutions of the type $\text{Nb}_2\text{O}_5\text{-AO/AO}_2\text{/A}_2\text{O}_3$ ($A = \text{Y}, \text{Bi}, \text{Hf}, \text{Zr}, \text{Ti}, \text{Fe}$ and Al). Samples were prepared by standard solid state techniques from the constituent oxides. Sample characterization was performed using variable temperature Powder X-ray Diffraction (VT-PXRD) in conjunction with the Rietveld refinement technique. Several of the materials currently under investigation have been found to exhibit low to moderate thermal expansion over a broad temperature range with evidence of hysteresis between heating and cooling stages. Currently, our focus is on establishing a structural relationship between the different Niobate materials in an attempt to correlate the thermal expansion behaviour exhibited by these materials. Selected results will be presented.

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Keywords: Rietveld, VT-PXRD, negative thermal Expansion

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The crystal structure analysis of release factor 3 from sulfate-reducing bacterium

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The translation of an mRNA is terminated when a stop codon is encountered. Since tRNAs do not recognize the stop codons, this event is done by proteins called release factors. Prokaryotes have three release factors, RF1, RF2 and RF3. The class 1 release factors, RF1 and RF2, hydrolyze and release the completed polypeptide from the tRNA at P-site in response to a stop codon. RF1 recognizes the stop codons of UAA and UAG, whereas RF2 does UAA and UGA. RF3 is a class 2 release factor, and it catalyses the removal of release factor RF1 and RF2 from the ribosome in a GTP-dependent manner. We have studied the structure-function relationship of the RF3 found in sulfate-reducing bacterium, *Desulfovibrio vulgaris* Miyazaki F. Here we present the high resolution crystal structure of RF3-GDP complex (Fig.1). Structural comparison with *E. coli* RF3 in the GDP-bound form as well as EF-G-2 and EF-Tu in the GTP-bound forms is also described.



Fig. 1. Crystal Structure of RF3-GDP

Keywords: X-ray crystal structure analysis, translation factors, GTP-binding proteins

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The structure and photoluminescence of chiral tin and lead inorganic-organic hybrid perovskites

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Inorganic-organic hybrids have been studied extensively in recent times because of the variety of interesting and useful properties associated with this family of compounds. The layered hybrids specifically the 2D $(\text{RNH}_3)_2\text{MX}_4$ and $(\text{NH}_3\text{RNH}_3)_2\text{MX}_4$ series, have shown good semi-conduction, photoconductivity, photoluminescent and electroluminescent behaviour [1]. These properties are dominated by the metal halide used [1]. The ability to fine tune these systems, structure and property alike; lies with the choice of the organic moiety. The choice of the organic moiety also influences the symmetry of the crystal. Chiral and polar crystals are of interest because of their inherent Second Harmonic Generation (SHG) nonlinear optical behaviours [2]. We report here the characterization and study of chiral amines in the following hybrid systems: the 2D $\text{MI}_4((\text{R})\text{-C}_6\text{H}_5\text{C}^*(\text{H})(\text{CH}_3)\text{NH}_3)_2$; $\text{MI}_4((\text{S})\text{-C}_6\text{H}_5\text{C}^*(\text{H})(\text{CH}_3)\text{NH}_3)_2$; and $\text{MI}_4((\pm)\text{-C}_6\text{H}_5\text{CH}(\text{CH}_3)\text{NH}_3)_2$ series where $\text{M} = \text{Pb}$ and Sn (Pb structures [3-4]). The 1D chains of $\text{MI}_3((\text{R})\text{-C}_6\text{H}_5\text{C}^*(\text{H})(\text{CH}_2\text{CH}_3)\text{NH}_3)$ and $\text{MI}_3((\text{S})\text{-C}_6\text{H}_5\text{C}^*(\text{H})(\text{CH}_2\text{CH}_3)\text{NH}_3)$ where $\text{M} = \text{Pb}$ and Sn . The photoluminescence of all of the above mentioned structures have displayed unique luminescence shifts from 77-293K of the respective enantiomer and racemic crystals. The luminescence behaviour is rationalized from the subtle structural changes observed following a series of SC-XRD studies done at different temperatures.

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